DLR Data Base Related Research 2017 and 2018

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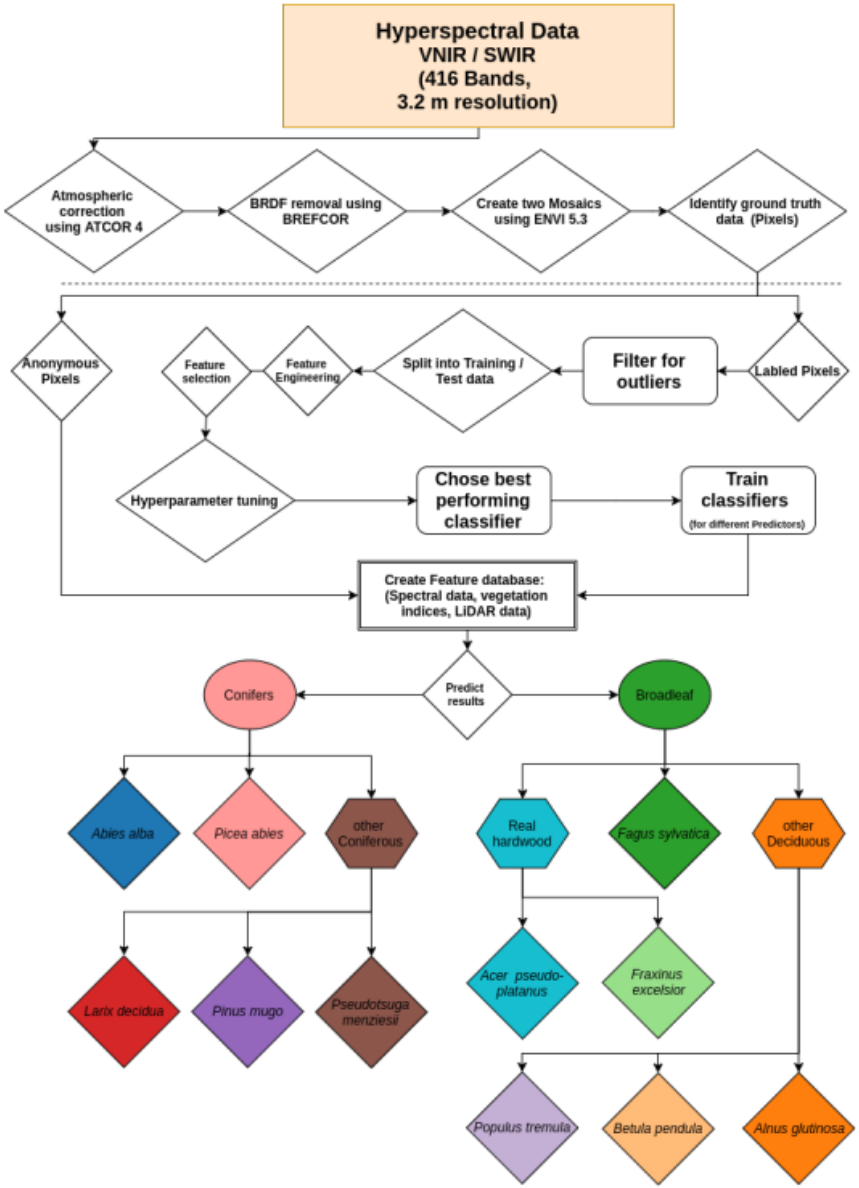
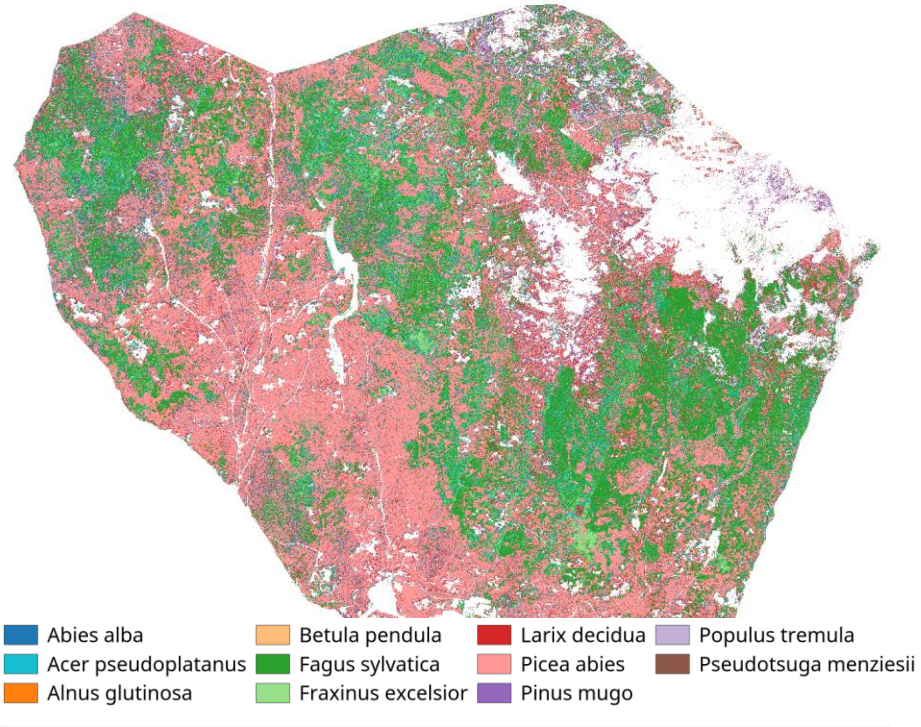
Supervised Machine Learning of Hyperspectral Data
Extremely randomized trees for classification of tree species

Master Thesis of Yannic Fetik, May 2017
Department of Geoinformatics, University of Salzburg

- Three different levels of complexity as basis for the classification: species, species groups, conifers / broadleaf
- Highest scores (Kappa, F1) were consistently obtained using the SWIR spectrum + VIs + LiDAR data
- Classifiers including the SWIR spectrum showed a higher ability of classifying specific species, such as Abies alba, Fraxinus excelsior and Picea abies as opposed to those classifiers that used the VNIR spectrum only
- Shadow pixels, remaining BRDF effects, over-fitting of single features (e.g. DTM) need to be taking into account when interpreting the results
  → highest score for the model does not necessarily imply a good representation of the reality

https://elib.dlr.de/115728/1/2017-05-01_Masterarbeit_YannicFetik_final.pdf


Hyperspectral Data
VNIR / SWIR
(416 Bands,
3.2 m resolution)
Atmospheric correction using ATCOR 4
BRDF removal using BREFCOR
Create two Mosaics using ENVI 5.3
Identify ground truth data (Pixels)
Anonymous Pixels
Feature selection
Feature Engineering
Split into Training / Test data
Filter for outliers
Labled Pixels
Hyperparameter tuning
Chose best performing classifier
Train classifiers
(for different Predictors)
Create Feature database: (Spectral data, vegetation indices, LiDAR data)
Predict results
Conifers
Broadleaf
Abies alba
Picea abies
other Coniferous
Real hardwood
Fagus sylvatica
other Deciduous
Larix decidua
Pinus mugo
Pseudotsuga menziesii
Acer pseudo-platanus
Fraxinus excelsior
Populus tremula
Betula pendula
Alnus glutinosa


Abies alba
Acer pseudoplatanus
Alnus glutinosa
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Fagus sylvatica
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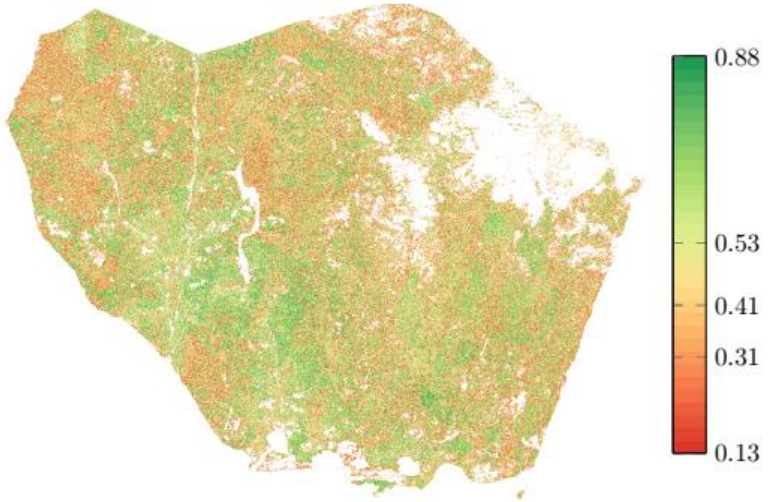
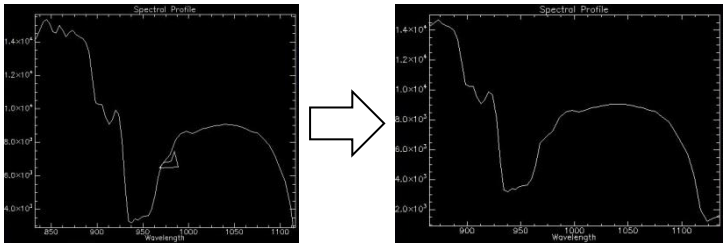
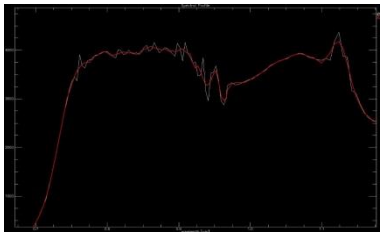
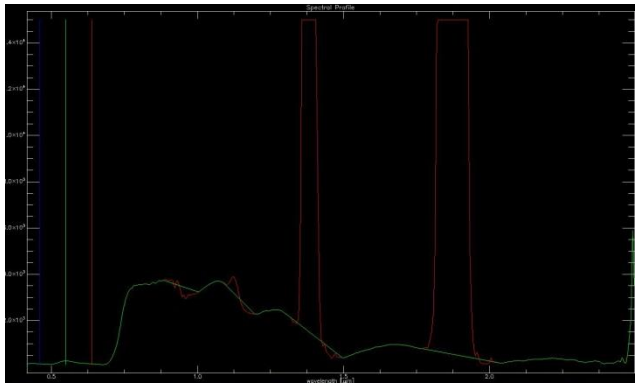

0.88
0.53
0.41
0.31
0.13

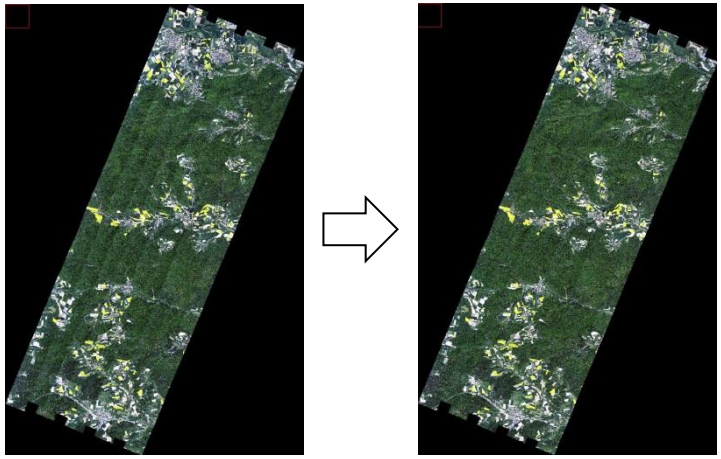
Optimized Processing of HySpex Data of 2015 and 2016

- Removal of overlapping Bands
- Atmospheric Correction
- Savitzky-Golay Filtering
- Removal of bands within the water absorption
- BRDF coorection









Further studies towards optimized processing of airborne hyperspectral data for forest studies

EUFAR Summer School RS4forestEBV

Airborne Remote Sensing for Monitoring Essential Biodiversity Variables in Forest Ecosystem

- 3rd -14th of July 2017 in the Bavarian Forest National Park and at DLR OP
- 19 young scientists from 15 nationalities
- Coordinated by ITC
- Field measurements and airborne campaign

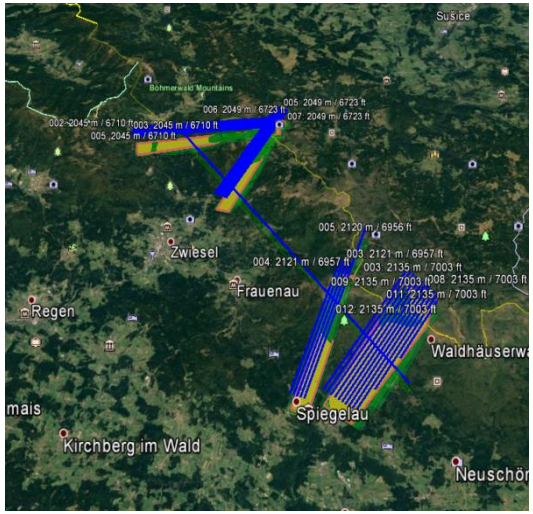
Reports and pictures available via www.eufar.net

March 2, 2018, 14:28

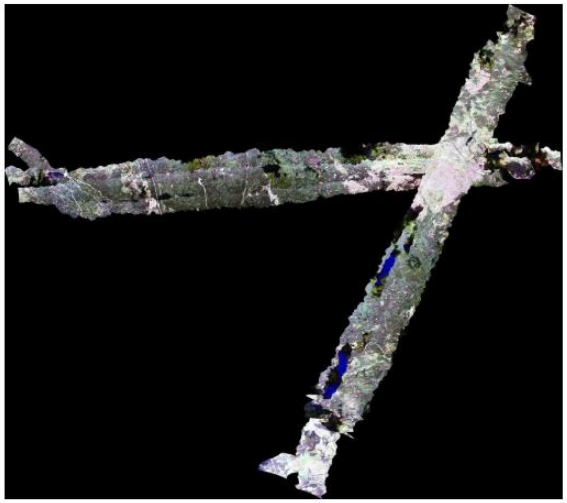
RS4forestEBV Training Course and Flight Campaign: Scientific Report

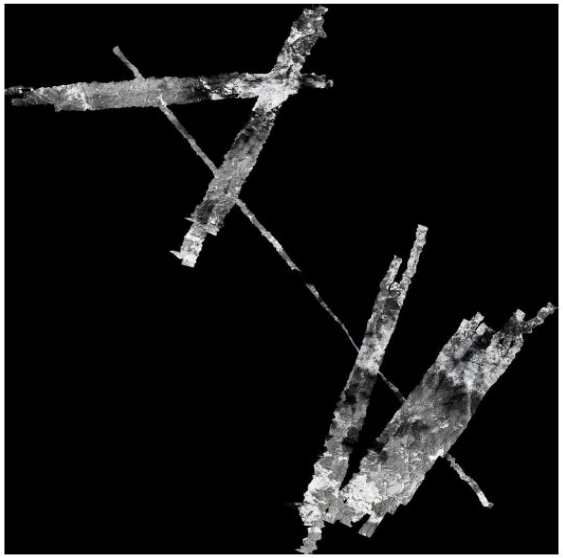
RS4ForestEBV Training Course - Airborne remote sensing for monitoring essential biodiversity variables in forest ecosystems Bavarian Forest National Park and DLR the German Aerospace...

EUFAR Summer School
Airborne Data



- Acquired 6th of July 2017
- 30 flightlines Aisa Fenix
- 30 flightlines Aisa Owl
- Data online available via http://data.ceda.ac.uk/badc/eufar/data/projects/rs4forestebv-a/





Tree species classification using plant functional traits from LiDAR and hyperspectral data

- Yifang Shi (ITC) guest scientist at DLR October 2017 – March 2018
- Paper submitted and accepted by the International Journal of Applied Earth Observations and Geoinformation

ELSEVIER

International Journal of Applied Earth Observation and Geoinformation

Volume 73, December 2018, Pages 207–219

Tree species classification using plant functional traits from LiDAR and hyperspectral data

Yifang Shi[a], Andrew K. Skidmore[a, d], Tiejun Wang[a], Stefanie Holzwarth[b], Uta Heiden[b], Nicole Pinnel[b], Xi Zhu[a], Marco Heurich[c]

Show more

https://doi.org/10.1016/j.jag.2018.06.018

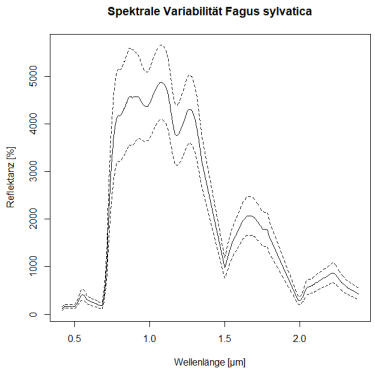
Highlights

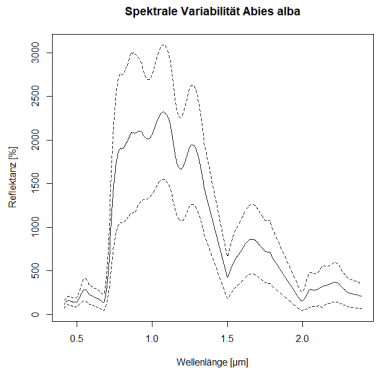
- Plant functional traits (PFTs) significantly contributed to tree species classification.
- Combining PFTs with spectral features and LiDAR metrics yielded the highest classification accuracy.
- Equivalent water thickness was the most robust PFTs for the classification.

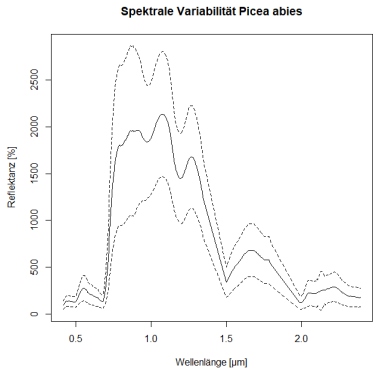
↗ contact Yifang for further information ☺

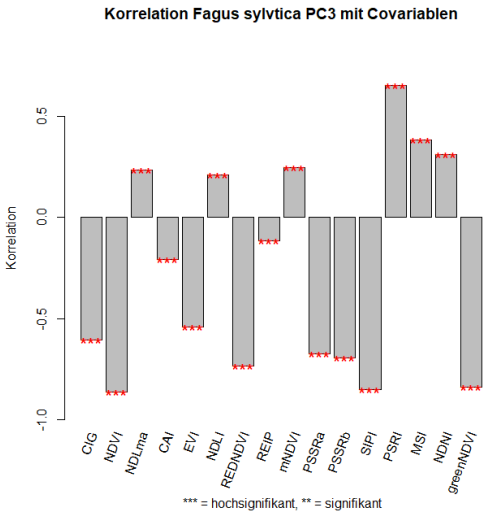
Intra-class spectral variability of tree species induced by topography and environmental parameters

Master Thesis of Simon Rosenberger, ongoing
Department of Geography, FAU Erlangen-Nürnberg









- consideration of different indices (carotenoid, nitrogen, moisture stress, canopy scale concentration,…)
- topographic parameters: elevation, slope, aspect, topographic position index

Erklärte Varianz [%]									
	Rechtswert	Hochwert	Höhe	Steigung	Sinus Peilwin	Kosinus Peilw	TPI3	TPI9	TPI15
Pice abies	17.22	22.64	57.47	29.80	17.22	9.24	-8.87	-4.90	-2.46
Abies alba	30.47	24.91	29.93	3.08	9.77	-4.75	-6.60	-2.73	-2.85
Fagus sylvatica	-2.41	-4.55	-4.85	6.76	2.70	1.27	-8.76	-4.63	-2.93